

Response to reviewer: *Andreas Möller – reviewer comments are in blue italics.*

We would like to thank the reviewer for his comments, and all his suggestions were carefully incorporated with changes made to the text and figures.

*One of my main general points of criticism in terminology is the use of the term “direct dating” from the Title on throughout the manuscript. As the manuscript itself explains repeatedly, dating pedogenic nodules means dating a pedogenic process and not “directly” dating sedimentation. I understand that the difference may be within the uncertainty of the obtained dates, but it is still incorrect. I Therefore recommend strongly this phrase should not be used and be struck from the title. Even is nodule formation is happening shortly after deposition, it is not “direct”.*

We concur that the term “direct dating” was probably used too loosely. While we date the calcite directly, it is true we do not directly date sedimentation but rather pedogenesis. To avoid confusion, we have reformulated this phrasing throughout.

*Introduction : Should take into account some recent paper on continental carbonates.*

We added relevant references to the introduction, including the one suggested in the comments.

*Results : The powder XRD data do not contribute significantly to the discussion or conclusion and could be put in the supplemental data. Chapter needs some checking of result and uncertainties to be matched between text and figures and an explanation why the two results from the same sample P00 are both used the average. This gives double weight to the result from that sample.*

The powder XRD data were removed and placed in the Supplementary Material. The misquoted age uncertainty was fixed and we checked all other uncertainties on figures and in the text to prevent any other discrepancies. The age results from the mapping experiment undertaken on sample P00 were removed from the statistical calculation and are only now used for comparison purposes, and only the spot analysis age results from sample P00 are now included in the statistical calculations.

*Discussion : Needs a bit more explanation in the biostratigraphic significance chapter, check the figure against the text, line 355ff. And be more specific how the approach used here is more reliable than others, line 362.*

A more detailed explanation based on both this comment and the suggestions in the annotated manuscript was added to the text and figures.

*Conclusions : The claims made here: “efficient” and “accurate” need to be better supported by specific explanations.*

We now give more elaboration regarding these points/claims, taking into consideration the comments raised by both reviewers.

*Figures :Some figures need more explanation or a better legend, Fig. 9 needs more explanation (see comment there).Supplementary figure 1 needs a detailed caption*

The relevant figures captions were revised according to the specific comments in the reviewer's annotated manuscript. Supplementary Figure 1 now has a detailed caption.

Tables : Supplemental Table 1 is missing from the supplementary files.

The analytical data is available at the following updated zenodo link:

<https://doi.org/10.5281/zenodo.14500416>

According to the instructions of *Geochronology* the dataset was referenced within the text using the hyperlink provided above.